

SPECIAL REPORT

OF THE

SUPERINTENDENT

OF THE

VIRGINIA MILITARY INSTITUTE,

ON

SCIENTIFIC EDUCATION IN EUROPE.



LETTER OF COL. COCKE.

BELMEAD, FEBRUARY 1859.

To His Excellency HENRY A. WISE,

Governor of Virginia.

SIR,

By order of the board of visitors of the Virginia military institute, I have the honor to communicate herewith a report of more than usual interest, from the superintendent.

The board of visitors were induced to grant a leave of absence, during the last year, to Col. Smith, the superintendent, to enable him to travel in Europe, for the double purpose of recruiting his health and strength, materially impaired by protracted official labors, and of examining the various institutions of learning as well as the systems of education in Europe, with the view of enabling the board, in co-operation with the enlightened observation and extended experience of the superintendent, to give such direction and development to the system of education peculiar to the institute, as should best adapt that system to the growing wants and requirements of the times and of the country, and thereby insure, as the results of it, the highest degree of efficiency and of public usefulness.

Col. Smith also bore with him to Europe, and in this connection, credentials from your excellency, of his official position and public mission.

Col. Smith visited the universities of Oxford and of Cambridge in England, besides many secondary educational institutions in Great Britain.

At Paris, he examined the polytechnic school, and through the special influence of our minister to France, he obtained what is but

rarely granted to foreigners, access to the great military school of St. Cyr.

In Germany and Italy, numerous military, agricultural and other schools were visited, the organizations and systems of which were carefully examined.

The experience of the superintendent, as the head of one of the principal institutions of learning in our state, and his recent observations of European systems of education, constitute the foundation and furnish the interesting materials of the present report.

The author of the report recognizes the fact of the growing want both in Europe and in this country, of a system of education different from that which grew up under monastic and ecclesiastical influences, upon the revival of learning in Europe, and which, from that time to this, has given form and direction to collegiate and university education both in England and America.

Physical science, with its applications to the arts, has come to change the face of society and the world. The Newtons, the Franklins, the Davys, the Wattses, the Whitneys, the Fultons and the Morses have come to seize and wield the hitherto secret laws and unknown powers of nature, and to become demi-gods of knowledge of power and of progress.

In England, this progress of physical science and of the arts has caused to arise by the side of the landed aristocracy and that of the established church, an aristocracy of commerce and of manufactures, whilst in America, the members of what are called the learned professions find themselves surrounded by an ever growing and influential class of agriculturists, of merchants and of manufacturers.

In England, the church and the landed aristocracy have built up and supported the universities of Oxford and of Cambridge; and in this country, the influence of the learned professions has modeled our colleges and universities after those two great English prototypes. But neither in this country nor in England has any adequate provision been made for the thorough and special education of the agriculturist, the merchant, the manufacturer, the engineer, or the

tist. These classes now loudly demand in both countries the establishment of institutions of learning, in which the mathematics and the physical sciences shall be thoroughly taught, together with their applications to the useful arts—so that whilst the universities shall be left to fill the sphere appropriate to them, the polytechnic schools may educate the future astronomer, the chemist, the soldier, the navigator, the agriculturist, the engineer, the merchant, the manufacturer, and the artist.

The course of instruction in the Virginia military institute being mainly mathematical and physico-scientific, may be readily extended and developed so as to comprehend the full course of a great polytechnic school, in which science would find its application to all the useful arts.

With our Virginia university occupying as it does the highest position amongst the collegiate institutions of the country, and our military institute developed into a polytechnic school of the highest order, the educational institutions of our state would be rendered pre-eminently comprehensive and controlling.

Commending the report, sir, to your favorable consideration,

I remain, very respectfully,

Your most obedient,

PHILIP ST. GEO. COCKE,
Pres. Board Visitors, V. M. I.

ORDER OF BOARD OF VISITORS.

At a meeting of the board of visitors of the military institute of state of Virginia, held at the capitol in the city of Richmond, Monday the 8th day of April 1858 :

The president called the attention of the board to the fact, that Mr. Francis H. Smith, superintendent of the institute, is about to visit Europe, with the full assent and approbation of the board : whereupon,

Resolved, that Colonel Smith be and he is hereby authorized and requested to visit the various seminaries of learning and other institutions of education in Europe, with a view to ascertain the operations and success of the various systems of education which exist there, and to enquire into the interests which are covered in the operations of the military institute of the state of Virginia—and that he report to this board, through the president, from time to time, if he shall deem it necessary, such information as he may obtain, or fully and finally, upon his return home.

And the board cordially tender to Col. Smith the expression of esteem and confidence, with their best wishes for a prosperous voyage and safe return.

Signed on behalf of the board of visitors.

JAMES L. KEMPER,
Pres. B. of V., V. M. I.

The above is a true copy from the minutes of the board of visitors.

R. H. CATLETT,
Sec. B. V.

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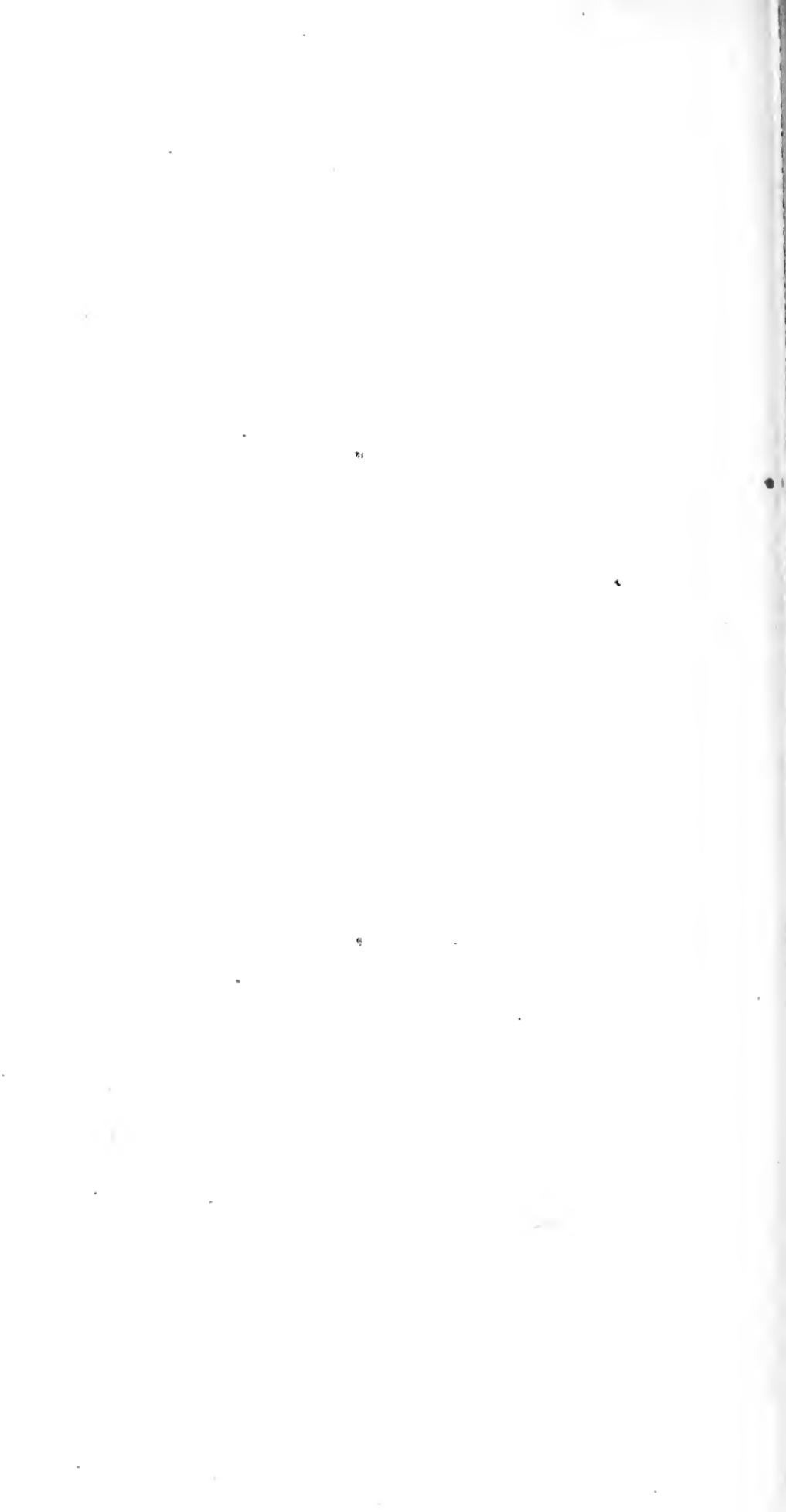
LETTER OF GOV. WISE.

It is hereby certified, that Col. Francis H. Smith, the bearer of this credential, is superintendent of the Virginia military institute; that James L. Kemper is president, and R. H. Catlett is secretary to the board of visitors of that institute, and that the foregoing abstract is duly certified, and that Col. Smith is duly authorized and requested as the said certificate purports. And the secretary of state of the United States is hereby requested to certify the seal of the state of Virginia, hereto annexed, to all foreign governments and people; and the ministers, chargés, consuls and commercial agents of the United States abroad, and all persons whomsoever, are hereby requested to give full faith and credit to Col. Francis H. Smith, in his character of superintendent and agent hereby attested.

In testimony whereof, I have hereunto set my hand as governor of the commonwealth of Virginia, and caused the seal of the state to be affixed this 19th day of April A. D. 1858.

Signed

HENRY A. WISE.



R E P O R T .

VIRGINIA MILITARY INSTITUTE,
FEBRUARY 1859.

COL. PHILIP ST. GEO. COCKE,

Pres. B'd Visitors, V. M. Institute.

SIR,

Availing myself of the kind indulgence of the board of visitors, I transferred the duties of my office to the senior professor, Major J. T. L. Preston, on the 1st of June last, and sailed for Europe in the steamer Africa, on the 9th of the same month. After spending six months abroad, I returned and resumed my duties on the 20th of December last.

In obedience to the instructions of the board of visitors, I beg leave to lay before you a special report, founded upon the results of my observations while abroad.

Besides the credentials contained in the resolutions of the board, I was honored by a special authentication of my official relations to the interests of the state, from His Excellency Henry A. Wise, governor of Virginia, which I found of great service to me, and for which I am under great obligations to him. These testimonials were most kindly received by the United States ministers and consuls abroad; and I would particularly acknowledge my indebtedness to His Excellency *Geo. M. Dallas*, U. S. minister at London; His Excellency *John Y. Mason*, U. S. minister at Paris; His Excellency *J. A. Wright*, U. S. minister at Berlin, and His Excellency *John M. Daniel*, U. S. minister at Turin; and also to *Beverly Tucker, Esq.*, U. S. consul at Liverpool, and *E. C. Stiles, Esq.*, U. S. consul at Vienna. From each of these gentlemen I received every attention; and but for their personal and official kindness, I should have failed in much that I hope to make serviceable to the general interests of this institution.

Judge Mason was unwilling to put my credentials upon the footing of mere formal letters of recommendation in my application for admission into the military schools of France. He insisted upon taking me in person to the minister of war; and by his kind intercession, I received at once, from *Marshal Vaillant*, letters of authority to visit the polytechnic school at Paris, the general military school at St. Cyr, and the artillery and engineer school of application at Metz.

It was not possible for me, in the brief time allotted to my trip to make more than a cursory survey of those interests, which are embraced within the operations of this institution. Extending as my tour did through England, Scotland and Ireland, France, Belgium, the German states, including Prussia, Austria, Bavaria and Wurtemburg, as well as Switzerland and Italy, I was necessarily limited to an examination of some only of the chief establishments of Europe; and even with regard to these, must refer, for much of my details, to the official reports and other documents which I have been able to obtain with reference to them.

In England, I visited Oxford university (then in recess), Cambridge university and the military school at Addiscombe; in France the polytechnic school, the military school at St. Cyr, and the *conservatoire des arts et metiers*; in Prussia, the military stables at Berlin; in Wurtemburg, the celebrated agricultural school at Hohenheim; and in Sardinia, the military school at Turin. In each of these establishments I was received with the most marked courtesy, every facility having been afforded me for a careful examination of everything that would be of interest to me in my enquiries. I would desire specially to acknowledge my indebtedness to *Major General Sir Frederick Abbott, K. C. B.*, commandant of the military school at Addiscombe; *General Eblé*, commandant, and *Colonel Riffault*, director of studies of the polytechnic school; *General Count de Monnet*, commandant of the military school at St. Cyr; Prince *Radziwill* of the Prussian artillery at Berlin, and *General Pettinengo*, commandant of the military school at Turin.

I reserve for a subsequent part of this report a reference to the universities of Oxford and Cambridge, desiring to direct special attention to a movement now in progress, in the modification of the

educational system of Great Britain, in which these renowned institutions are bearing a leading part. As these modifications have a most intimate connection with the past operations and future development of this institution, I shall deem it proper to dwell with some particularity upon the causes and results of this movement, believing that a correct view of them will be of immense value to those who may be charged with the direction of this institution.

The military school at Addiscombe belonged until recently to the East India company, and was designed to supply officers for the military service of that company in India. Under its existing organization, it is rendering to her majesty's government in India the service formerly discharged for the East India company. It numbers about 150 cadets, who are admitted without competition, upon examination, and who serve two years. Those designed for the engineer service are transferred, on the completion of their course at Addiscombe, to the royal engineer establishment at *Chatham*, for practical instruction in engineering, where they remain 18 months. Those who enter the artillery or infantry services, pass at once into the public service in India, with a rank as lieutenants, corresponding with their respective class grades. I was very much struck with the *sand models* connected with the course of engineering in this school. Models in engineering as well as in all practical sciences, are of great value to the right conception of the application of the principles taught, and their general use has been much restricted by the great expense of those usually made in wood or plaster. The professor of engineering at Addiscombe uses *common sand*, with great advantage, for all models required in his department, and by its adhesive property when slightly moistened with water, all the necessary models can be readily made from designs prepared by the professor. I saw, in the model room, models of three different plans of forts used in India, which were as perfect as if made with the best wood, and which had been formed by a common soldier in a few days' labor. Forty loads of sand had served for these uses for a period of 15 years, without perceptible diminution from wastage.

The English military schools are also devoting much attention to the art of *photography*. The engineering drawings required for the military and civil services of so extensive an empire, involve great labor and expense, and it has been found that the *photographic* art

may be most readily applied in most of those drawings which require so much repetition, and thus copies to an indefinite extent, plans of forts, buildings, &c. may be multiplied, at comparative small expense of time or labor. The cadets at the military school at Addiscombe are taught this useful art.

The polytechnic school at Paris (l'Ecole impériale polytechnique) known at first under the name of *Central school of public works (Ecole centrale des travaux publics)*, was established in 1794.

By a decree of the French convention of 11th March 1794, a commission was appointed for the purpose of establishing a central school of public works. The decree specified 22 of the principal cities of France as centres of examination, at which candidates for admission were to report themselves, and furnish proofs of their qualifications, by examination in arithmetic, algebra and geometry, and the school was opened on the 21st of December 1794. Under this organization, the course of studies was divided into two principal branches, viz: *Mathematics* and *physical sciences*, the first division embracing analysis, with its applications to geometry and mechanics, and descriptive geometry, including architecture, fortification and drawing—while under the head of *physics*, were embraced general physics and chemistry. Thus organized, the school was conducted until the 1st September 1795, when, by a new decree, its name was changed to that of *Ecole polytechnique*. This new organization differed but little from the first, and simply determined the mode of admission of its *élèves* into the public services.

By a law of 22d October 1795 *schools of application* were established, the course of study in the polytechnic school was limited to two years, and its relations to the special schools of application defined. To accommodate the school to these new relations, an organization was made 16th December 1799, by which important changes were made in the classification of studies, and a board of improvement (*conseil de perfectionnement*) established; and finally, by a decree of 16th July 1804, the military organization of the school was fully effected.

“The origin of the polytechnic school [I quote from the report of the commissioners appointed by the British government to co-

er the best mode of training officers for scientific corps] dates m a period of disorder and distress in the history of France, which seem alien to all intellectual pursuits, if we did not remem-
ber that the general stimulus of a revolutionary period often acts powerfully upon thought and education. * * * * It was intended at first to give a complete education for some of the public services, but it was soon changed into a preparatory school, to be succeeded by special schools of application.

“ When the school was first started, there was scarcely another of y description in the country. * * * * All schools from the iversity downwards, were destroyed; the large exhibitions or urses, numbering nearly 40,000, were confiscated or plundered by dividuals, and even the military schools and those for public orks (which were absolutely necessary for the very roads and the fence of the country), were suppressed or disorganized. The hool of engineers at Mézières (an excellent one, where *Monge* had en a professor), and that of the artillery at La Fère, were both en open up, whilst the murder of *Lavoisier*, and the well known ging with respect to it, that the republic had no need of chemists, ve currency to a belief, which *Fourcroy* expressed in proposing e polytechnic, that the late conspirators had formed a deliberate an to destroy the arts and sciences, and to establish their tyranny the ruins of human reason.

“ Thus it was on the ruin of all the old teaching, that the new in-
stitution was erected—a truly *revolutionary school*, as its founders lighted to call it, using the term as it was commonly used, as a homonym for all that was excellent. And then for the first time owing the principle of public competition, its founders, *Monge* and *Fourcroy*, began their work with an energy and enthusiasm which ey seem to have left as a traditional inheritance to their school. is curious to see the difficulties which the bankruptcy of the untry threw in their way, and the vigor with which, assisted by e summary powers of the republican government, they overcame em. They begged the old *Palais Bourbon* for their building—ere supplied with pictures from the *Louvre*—the fortunate capture an English ship gave them some uncut diamonds for their first periments—presents of military instruments were sent from the enals of Havre—and even the hospitals contributed some chemi-

cal substances. In fine, having set their school in motion, the government and its professors worked at it with such zeal and effect that within five months after their project was announced, they held their first entrance examination, open to the competition of all France, and started with 379 pupils."

The polytechnic school thus came into being a "revolutionary school." Its subsequent career was unprecedented. Its high reputation was built up by the unwearied labors of men, whose names are as household words wherever science has a votary. *La Grange*, *Lacroix* and *Poisson* laid the basis of its course of analytical mathematics; *La Place*, *Labey*, *Proney*, *Francœur* and *Ampère*, that of analytical mechanics and astronomy. Descriptive geometry and its applications had for their first teachers the illustrious founder of the science, *Gaspard Monge*, and his pupils, *Hachette* and *Arago*. Chemistry and mineralogy were taught by the great masters, *Berthollet*, *Fourcroy*, *Gay-Lussac* and *Thenard*; while fortification, architecture and public works were entrusted to *Guy-Vernon*, *Durand* and *Sganzin*.

To these great masters was added a corps of *répétiteurs* (repeaters of lectures, or assistant professors), chosen from the most distinguished of its pupils, among whom we find the distinguished name of *M. Biot*. It was my high privilege to have several interviews with this nestor of science, in his rooms at the *Collège de France* and it was with sadness he referred to the great changes which the revolutionary struggles of his country had brought upon the character of the institution; adding, "*the polytechnic school is not now what it once was.*" True, its great masters had passed away. It had no longer the ardent enthusiasm of a Monge and Fourcroy, of Berthollet and La Place and La Grange, but the traditional lustre of their great names still shed light over the school which their genius and labors had built up. True, disputes had arisen between the exclusive study of abstract science on the one hand, and their early application on the other, which legislative authority had attempted to solve by an accommodation to the spirit of Young France; but the traditional teaching of the school will be too strong for legislative interference; and "*early and deep scientific study*" will carry off the victory against early practical applications," so that the opinion of the English commission is distinctly given in pronouncing

the polytechnic school at this time, "perhaps without exaggeration, the greatest mathematical school in the world."

With such illustrious men to conduct the educational development of the polytechnic school, sustained as they were by the genius, wisdom and authority of Napoleon I, it was to be expected that it would exercise a commanding influence in the progress of scientific education throughout Europe, and in the organization of those special schools which have added so much to the power of the French nation. And such has been the result. No intelligent traveler can visit Europe, without seeing the impress of the polytechnic school upon the progress of education, in all the forms of its development. And when the American contrasts the character of education in his own country, at the beginning of the war of 1812, with that at present, he will not fail to recognize the important agency of the *U. S. military academy at West Point*, itself a germ from the polytechnic school, with one of the polytechnic élèves (Claude Crozet) as one of its earliest professors, not only in the specific work of preparing officers for the military defences of the country, but in elevating the character and grade of its scientific education. Nay more—may we not trace in the history of the *Virginia military institute*, itself an offshoot from the West Point academy, a still further development of a system of education, originating in the troubles of a revolution, which, in its weariness of every thing then existing, threw off the restraints of the scholastic teaching, and gave birth to the *polytechnic school*?

Still, it would be absurd to trace such astonishing results to the influence of any one institution, however renowned the men charged with its teachings, or mighty the authority brought to their aid in its operations. There must have been a *want* existing, whether felt or not, for the class of education which the polytechnic school first met and supplied. How could the education which was originally designed for the ecclesiastic, and which was made by the system of the schools the education of *all*, meet the wants of a great nation in the development of its resources, the application of its material, the adaptation of machinery, the success of its manufactures, the progress of the arts, or the success of its trade? The education which had been provided was actually *worthless* to most of those who held the wealth and directed the destinies of the nation. And thus,

just in proportion to the adaptation of the system of education to meet the demands of the age, must be the influence which it will exert in the promotion of sound learning in the world. That this requirement was fulfilled in the establishment of the polytechnic and other special schools connected with it, there can be no rational doubt. This has long since been admitted throughout the continent of Europe. It is about to have a remarkable confirmation in the judgment of the great educational establishments of England, as will more fully show in the sequel of this report; and I call attention to this point here, because it illustrates and confirms an important principle which has marked the history and seems to fix the destiny of the Virginia military institute.

The immediate and pressing wants which led to the establishment of the polytechnic school, controlled also its plan. It was partly military and partly civil, for military as well as civil education had been destroyed by the revolutionists. At first it only included those who were designed for the engineer service, but the artillery service was added within a year. The preparation which it gave for the military service, was in its thorough scientific rather than its practical training; and those of its élèves who are destined for the army, are transferred to the practical school for engineers and artillery at Metz. For many years past, it has been more a civil than a military school, its best pupils selecting the civil in preference to the military services, because they open wider fields for distinction and advancement. To such an extent have the civil departments monopolized the best talent of the school that the directors of the school at Metz have complained that the material sent to that institution, constituted as it is of the lowest members of the classes of the polytechnic, is not qualified, by talent or preparation, for those arms of the service provided for at Metz. These remonstrances have not operated to remove from the polytechnic students the free choice which they continue to give for the civil services.

It will thus be seen, that the polytechnic is a *preparatory and general scientific school*, in which the studies are not exclusively adapted for any one of the departments to which, at the close of its course, its scholars will find themselves assigned. Before entering upon the actual discharge of their specific duties, they pass through

further term of instruction in some one of the schools of application specially devoted to particular professions.

The public services for which it thus gives a general preparation, are the following, in the order of their selection by the preference of the élèves :

The department of roads and bridges (ponts et chaussées).

The department of mines (mines).

The department of powder and saltpetre (poudres et salpêtre).

Naval architects (génie maritime).

Engineers (génie militaire).

The artillery (artillerie de terre).

Staff corps (etat major).

The hydrographical corps (ingénieurs hydrographiques).

The department of tobacco (administration des tabacs).

The department of telegraph (lignes télégraphiques).

Navy (marine).

Marine artillery (artillerie de mer).

And finally, to all other departments which involve a knowledge of mathematics, physics or chemistry.

The course of study at the polytechnic embraces two years, and the institution is open to all Frenchmen by competition. It usually numbers about 400 students, about one-third of whom pass out each year to the various schools of application. Besides a full corps of professors, the lectures given by these are carefully drilled into the pupils by the *repetiteurs*, who pass through the halls of study (salle l'étude), ask questions, repeat the lectures when necessary, and give such additional instruction as may be required; so that the fullest scope is given to the genius and diligence of the pupil on the one hand, and facility for necessary aid from the instructors, on the other. This care in instruction involves the expense of a large corps of professors and assistant professors, but the advantages resulting from it fully compensate for the expense attending it. And if the distinguished career of its élèves be a fair test of the value of its system of instruction, few institutions in the world can pre-

sent a fairer record in the same space of time than the polytechnic school.

Among those who have been most distinguished, I note the following:

Arago, savan, professor at the school.

Bachasson de Montalivet, minister of interior.

De Barante, ambassador.

Bernard, minister of war.

Biot, savan, professor Collége de France.

Binet, professor at Collége de France.

Bourdon, inspector general of university.

Cauchy, professor at the school.

Cavaignac, minister of war.

Chasles, professor at the school.

Chevalier, professor at Collége de France.

Comte, repétiteur at the school.

Delauny, professor at the school.

Doalat de Pontecoulant.

Ducos de la Hette, minister of foreign affairs.

Dulong, professor at the school.

Duhamel, professor at the school.

Dupin, professor at the school, and minister of marine.

Franceœur, professor in faculty of sciences.

Gay-Lussac, professor at the school.

Le Chevalier, professor at the school.

Le Verrier, member of the institute.

Lionville, professor at the school.

Malus, member of the institute.

Mathieu, professor at the school.

Poinsot, professor at the school.

Poesson, professor at the school.

Poncelet, commandant of the school.

Regnault, professor at the school.

Vaillant, minister of war and marshal of France.

I close my notice of the polytechnic school, by quoting the conclusions of the intelligent commission of the British government, before referred to :

“ Regarded simply as a great mathematical and scientific school, its results, in producing eminent men of science, have been extraordinary. It has been the great (and a truly great) mathematical university of France.

“ Regarded again as a preparatory school for the public works, it has given a very high scientific education to civil engineers, whose scientific education in other countries (and amongst ourselves) is believed to be much slighter and more accidental.

“ Regarded as a school for the scientific corps of the army, its peculiar mode of uniting in one course of competition for civil and military services, has probably raised scientific thought to a higher point in the French than in any other army.

“ Regarded as a system of teaching, the method it pursues in developing the talents of its pupils, appears to us the best we have ever studied.

“ It is, in its studies and some of its main principles, that the example of the polytechnic school may be of most value. In forming or improving any military school, we cannot shut our eyes to the successful working at the polytechnic of the principle, which it was the first of all schools to initiate, the making great public prizes the reward and stimulus of the pupil’s exertions. We may observe how the state has here encouraged talent, by bestowing so largely assistance upon all successful but poor pupils, during their school career. We may derive some lessons from its method of teaching, though the attempt to imitate it might be unwise. Meanwhile, without emulating the long established scientific prestige of the polytechnic, we have probably amongst ourselves abundant materials for a military scientific education, at least as sound as that given at this great school.”

The special military school at St. Cyr is the same that was originally established at Fontainebleau in 1803, and was transferred to

St. Cyr in 1808. The buildings occupied by the school are those formerly used by *Madame de Maintenon*, and the school which she superintended, near the village of St. Cyr. To enter the infantry, cavalry or marine services, a young man may either rise from the ranks, or successfully pass through the course of study prescribed at the military school at St. Cyr. It is possible, in time of war, that a private may rise to be an officer of engineers or artillery, but the number thus promoted is limited; and as a general thing, they are afterwards required to take a modified course at the special school for engineers and artillery at Metz. Besides furnishing officers for the infantry, cavalry and marine, about 25 of the most distinguished of each class are, at the close of their term at St. Cyr, brought into competition for admission into the staff school (Etat Major) at Paris, the superior advantages of this department thus affording a strong stimulus to exertion.

The course of study at St. Cyr is 2 years, and the institution usually numbers about 5 or 600 cadets, who are admitted by competitive examination. The buildings from several courts or quadrangles, named after the battles of Napoleon, as the court of Rivoli, the court of Austerlitz, &c. The ground floor forming the courts of Marengo, Austerlitz and Wagram, appeared to be occupied by two refectories, by lecture and other public rooms. On the 1st floor are the *salles d'étude*, and the public rooms containing models, &c. On the second floor are the dormitories.

The *salles d'étude* accommodate about 200 pupils, arranged on parallel seats, with a narrow passage between, and are used as general *study rooms*, in which the pupils prosecute their studies, in the presence of one or more officers of the institution.

The *refectories* were arranged with two rows of small tables, each table accommodating 12 cadets, and a long narrow passage separating the parallel rows of tables.

The *dormitories*, containing about 100 each, named after the Crimean battles, *Alma*, *Inkermann*, &c., were occupied by rows of small iron bedsteads each with a shelf over it and a box by its side. The cadets make up their own beds, clean their own shoes, and attend to the police of their dormitories.

I did not see the infantry drills, as they take place shortly after sunrise, but I witnessed, on two occasions, the exercises for the cavalry service. The stables contain about 350 horses, attended to by 200 cavalry soldiers. The cadets for the cavalry service ride 3 hours a day, and the exhibition which they made was very creditable to the school.

I was much interested in the models connected with the engineering and mathematical departments of the school, and was induced, from the great value of some of them, as aids in our own course of study, to order a few of the most important for this institution. I am sure that nothing could contribute more to an improvement of these departments at the institute, than a full collection of these models; and I hope that the means to purchase them may be given at no distant day.

The *competitive* examinations upon which cadets are admitted into the military schools of France, besides elevating the character of the material introduced into the public services, exercise a most powerful influence upon the civil common schools of the country. Upon this point, I quote again from the English commissioners' report :

“ This is one piece of advice [said a distinguished French general, well known as a man of science, in conversation with us]. Fix our programme for admission at a high point; keep rigidly and uncompromisingly to it; reject all who do not reach it; and raise it gradually; reparation will be made accordingly; the pupils will say to their masters, This is required—teach us this; and you will gradually raise the standards of all the preparatory schools in the country. So at least it has been in France.”

And the commissioners add, “ So certainly it does seem to have been. The standard in certain studies has been steadily elevated, while the importance of others has been gradually reduced; and in fact, a complete revolution in the whole system has been effected.”

These remarks are fully confirmed by the observation made to me by Sir Frederick Abbott, of the military school at Addiscombe, who recommended an open and competitive examination for Addiscombe, not only from the advantages likely to accrue to the institution

itself, but as inevitably tending to elevate the grade of all those schools which would be looked to as preparatory to the military schools of England.

I have dwelt so much at large upon the character and operation of the military schools of France, that it may not be necessary to go into the same detail with regard to the other establishments of the kind which I was permitted to examine in Europe.

I was very much pleased with a visit made to the *Royal military academy* of Sardinia. The establishment of a more liberal government in Sardinia since the revolution of 1849, has infused new energy into the operations of the government, and no interest has more sensibly felt this than that connected with military education. The buildings used for the purposes of the Royal military academy are contiguous to the royal palace, and are in many respects admirably arranged for the purposes of a military school. The governor of the academy, General *Pettinengo*, accompanied by members of his staff, very kindly took me through every part of the establishment—the refectories, the dormitories, lecture rooms, and examination halls, hospital, &c.—all of which seemed to be admirably suited for the uses to which they were applied.

I was particularly interested in the *drawing* department, to which I found great attention paid in this school. As tests of the qualifications of the cadets, examinations in drawing were required at the close of each term, at which the merits of the pupils were determined by the quality and dispatch exhibited in the drawings executed in an allotted time.

The military academy at Turin also attaches great value to the preparation of original *memoirs*, which are required of all the senior cadets. Musket and rifle target practice receives also much attention there. In a word, I was very much pleased with all that I saw in this institution, and left it with the impression that it must exert a commanding influence upon the cause of general as well as military education in Sardinia.

In all the military schools of Europe, great attention is paid to gymnastic exercises. These are not only practiced for the pur-

f developing the manly vigor of the pupils, but as essential elements in the discipline and instruction of troops for light service. They are generally conducted under the direction of an officer who acts as instructor, and are regarded as a part of the regular system of instruction. At Vincennes, St. Cyr, as well as at Turin, the arrangements for these exercises were very perfect, and the system is well worthy of the consideration of this school.

The great agricultural school of Germany is at Hohenheim, in Wurtemburg, six miles south of Stuttgart. Hohenheim (High-Home) was originally a ducal palace, which was transferred, on the coronation of the present king of Wurtemburg, to the uses of an agricultural school. The extensive ranges of court rooms, servants' rooms, halls, stables, &c. which constituted the arrangements of the royal residence, came in most admirably for the new uses to which they were applied. The public halls answered very well for the exhibition and instrumental rooms; the stables, for the cattle and sheep—while dormitories for 130 students were easily provided in the long ranges of the second floor. The school was unfortunately in vacation when I visited it, but I found one of the sub-officers there, who spoke French, and he, together with an intelligent student from Belgium, showed me every attention, and seemed pleased to afford me all the information at their command.

This school is a great scientific and practical school of agriculture. It is not a manual labor school, although any student is at liberty to labor if he choose. The basis of the school is careful instruction in scientific agriculture, embracing chemistry, geology, mineralogy, mechanics, physiology, animal as well as vegetable, and every thing belonging to the diseases of animals and stock. The principles thus taught in the class room are made the basis of the experimental instruction on the farm, for 1,000 acres of good arable land are attached to the school. Does science show that the application of a particular manure will be judicious—the experiment is made, and the results carefully noted, and this not slightly, but with patient and laborious care. When the result is fully established, it is proclaimed, and becomes the established rule for the farmer everywhere. Is the manufacture of *cheese* the subject before the class—the professor will deliver his lecture, explain the rationale of the process, and also the manipulations necessary; and while the lec-

ture is in progress, the milk will have passed from its liquid state to that of pressed cheese. So that theoretic and applied science is so joined in the instruction here, that *Hohenheim* is regarded throughout Germany as the authority on agricultural matters, which determines all questions of policy in this branch of industry; and a knowledge of this fact makes the professors slow to express an opinion on any point, until conclusive evidence satisfies them which is the true answer. Thus, an enquiry was presented as to the relative economy in feeding 100 weight of hay to cattle or sheep, and the result was favorable to the latter in the proportion of some 20 per cent.

All new implements of agriculture are sent to Hohenheim for testing. The professor will explain to his class, before they are tried, the mechanical principles involved, their effect upon the draught of the animal, as founded upon his physiological structure and then the test is made.

In Germany, oxen pull by the horns, the band passing in front of the head just below the roots of the horns. This is not an accidental arrangement, but reasons are given for it, founded upon the form and strength and durability of the animal.

The model rooms contained every variety of agricultural implements, among which I noticed with pride the reaper of our own countryman, *McCormick*. The implements which were not on hand for use in the field, were exhibited by most carefully constructed models. In the seed-room, every variety of seed and root was tastefully arranged; and these specimens are not exhibited merely to be looked at. Their peculiar properties are carefully unfolded by the lecturer, as he presents them to his class. My eye rested upon a fine specimen of a common potato. I took it up, and finding it much lighter in weight than a potato of its size should be, I enquired how it had been so carefully preserved. My guide laughed heartily at my question, and replied, that the specimen I held was a *model in wood*. And models in wood were shown, in like manner, of apples, cherries, &c. all of which would have equally deceived me, had not my attention been drawn to the model potato. In the same room were specimens of wool of every variety, carefully arranged by classification.

I was particularly interested in the hall of *forestry*. Here every variety of *wood* was seen in choice specimens, and classified, each class embracing those timbers which possessed distinct peculiarities: thus, timbers which would bore without splitting; then those that might be turned; and also those that could be reduced to thin laminationæ—all of which was very suggestive to me as presenting one important defect in our American education. With every variety of the noblest forest trees upon earth, so little attention is paid to their study, that our young men scarcely know the *names* of the trees as they pass them in the woods, much less their qualities and properties; and yet is there any part of agriculture so well deserving of attention as the culture, preservation and properties of our forest timber.

The cattle stables contained some 70 or 80 very fine cows of the Swiss breed, the calves from which were raised and sold for *labor*. They are never removed from their stalls except to water, twice each day; and their food is regulated by carefully tested experiments.

Some *twenty-five* mechanics are employed constantly at the school in making implements and models, which are sold.

The school is composed of the *academy* proper, and *institute*, or school of application. The charges of the first are about 30,000 florins (say \$12,000) annually, and these are met by the tuition fees of the students. The expenses of the *institute* amount to 40,000 florins (\$16,000), and the sales of stock, produce from the farm, and models, about equal the expenditure—so that, as nearly as I could ascertain, the school is *self-sustaining*.

The expenses to each student amount to about \$300 a year, and this sum may be reduced by the student availing himself of the facilities for cheap boarding in the neighborhood. I found the school deficient in public documents. They had nothing except in *German*; and I was only able to get a couple of pamphlets in this language, giving a programme of the course of studies and discipline.

It is well known to you, sir, that peculiar circumstances have directed the policy, and seem still to fix the destiny of this institution. Called into being as a substitute for what was considered an evil in the established guard then attached to the Lexington

arsenal, without any distinct or definite sphere of operations before it as an educational establishment, in the minds of its original founders, it has been developed, from year to year, partly under the influence of controlling causes within the institution itself, and partly from what has seemed to be an imperative call of duty from without. As it has progressed, its destiny has seemed to mark it out more and more distinctively to be to Virginia and the South, what the polytechnic school and the special schools connected with it, have been to Paris and to France—a *general scientific school*. Its military character as a part of the public guard of the state; its distinctive organization upon the basis of the United States military academy at West Point; its normal character as a school from which the state might be supplied with a corps of competent *native* teachers; the demand for its graduates in the important interest of civil engineering—and in general, the *felt necessity* for a school of physical sciences, where, to use your own language, “our young men will study nature in all her infinite and immutable laws, and whence they will come out, learned in science, skillful in practice, with powers to wield all the laws of nature in behalf of the physical, intellectual and moral progress of their country”—these are the circumstances which have shaped the destiny of the institution, and which have brought the board of visitors to the conviction that it is their duty to make it a great school of physical sciences for the south.

The gradual steps in this development have not been taken without careful consideration on the part of its friends, and without awakening some apprehension lest in the tendency to what might be called a practical education, the directors of the school might lose sight of the true object of education as designed rather to develop the mental and moral faculties, than to qualify the student for the active duties of life—lest the too exclusive prosecution of scientific studies might lead to a narrow, contracted, one-sided and sometimes skeptical state of the mind—and finally, lest the influence of the example founded upon the experience of the great educational establishments of this and our mother country, England, might be lost sight of in the swelling tide of *progress* which marks the character of the age.

These suggestions have been met by the facts, that it was still an unsettled point what class of studies was best adapted to de-

elop the powers of the human mind, inasmuch as the results, founded upon experience, were too much influenced by natural or contingent causes, to be made the basis of any dogmatic conclusions on the subject—that education, to be worth any thing, must have respect to the duties of life, and that the education which was useful to *some*, was not necessarily useful to *all*—that truth, divine truth alone could put straight the perverted and perverting condition and tendency of the human mind, and was equally applicable under one as under another system of mental training—and finally, that the established institutions which had come down to us from the past, would either have to adapt themselves to the generation upon which they were to act, and to the felt necessities of the world, under the existing circumstances of society, or they would be useless for the purposes for which they were established.

I had little expected that my observations abroad would furnish me with such conclusive demonstration of the correctness of these views. I had expected to find on the continent of Europe much that was in sympathy with the general tendency of the operations of this school; but I had not imagined, for no sufficient data had previously existed to enable me to see, to what an extent the mind of the British nation had been awakened on these various questions, and how fully the response had been in harmony with the views here expressed, and with the developments which have marked the progress of this institution.

Let it not be supposed that this awakening has involved any depreciation of the value or importance of the old systems of education, as they had come down from the past, for the peculiar objects and purposes for which they were in many respects admirably suited, or that the views now extensively gaining ground, are intended to supersede these old teachings; but that the public mind is becoming more and more satisfied that the education which was useful to *some*, was not necessarily useful to *all*—that there is now a more decided acknowledgment of the fact that the wants of the largest and most influential part of society, embracing the middle ranks, with some mixture from the upper and lower classes, and comprising the agriculturist, the merchant, the manufacturer, the artist, the civil engineer, the artisan, and to some extent, the professions of law and medicine, are not provided for by the existing systems of the schools;

and that measures are now in progress to supply these wants, in which the universities of England are prominently lending their influence, and by which provision will be made to give an education at least as *liberal* as that supplied by the "schools."

When I reached England, I found the public papers much interested in what was termed "*the middle class examinations*" of Oxford and Cambridge. At first I had supposed that these examination had reference to the candidates of these universities for honors, or certificates of distinction; on discovering my error in this conjecture and seeing that the examinations referred to were of the pupils of schools not connected with the universities, I had supposed that the term "*middle class*" defined the *class* of boys who were the subjects of these examinations, as coming from the *middle walks of life*. I was equally in error here. The term "*middle class*" is understood to apply not so much to the *individual* educated, as to the *education* itself, as one lying between the high culture attainable at a university and the humble rudiments required at a parish school. And it was in reference to this class of education that these examinations were then in progress.

On the 18th of June 1857 the university of Oxford passed a statute establishing two examinations for those *not members* of the university—one for youths under 18, another for boys under 15. By this statute a commission was organized, with legislative and executive powers for the several purposes defined by the statute, these powers to expire in three years.

This commission was authorized to frame a scheme of examination, appoint examiners, to fix a scale of fees, and arrange all the details of the examinations.

The examinations were to be held at various *centres*, chiefly the large towns, selected as the commission should deem most expedient.

The "*middle class*" examinations thus appointed, were to be free to all persons of whatever social rank or religious denomination, *age*, and *non-matriculation* being the only limit.

All candidates must satisfy the examiners that they have mastered

the elements of a plain English education, after which they are allowed a wide latitude in the selection of subjects of study.

Boys under 15, who succeed in the lower examination, obtain a certificate. Youths under 18, who pass the higher, receive the title *associate of arts.*

The university of Cambridge has followed the example of the university of Oxford, and passed a similar statute for middle class examinations. The details of this statute differ in some of its elements from those of Oxford, the chief difference being in reference to the title of *associate of arts* to the successful seniors.

The motives which have led these renowned universities to inaugurate so important a system as is embraced in these middle class examinations, are fully set forth in the memorials which have been presented to them from the various interests connected with them; communications from masters of schools who have recommended them; and in an elaborate argument of one of the Oxford examiners, *T. D. Acland, Esq.,* himself late a fellow of *All Souls College, Oxford,* in an account of the "*Origin and Objects of the New Oxford Examinations,*" published in 1858.

The memorial of the *medical profession* of London states, "We believe that the adoption of such a system (middle class examination) may be most beneficial, by supplying a means primarily for testing, and secondarily for increasing and guiding the preliminary knowledge of many who are destined for the study and practice of medicine, thus meeting a want which has been long and deeply felt."

The *architects* of London join in the memorial, because they "think that if some knowledge of the history and principles of the arts, and of the physical sciences connected with them, were encouraged as a part of the general education of the middle ranks, much national benefit would result from the more just appreciation of the works of professional men."

At a meeting of the committee of the metropolitan and provincial law association, held on the 19th January 1858, it was "Resolved, that this committee has seen with great satisfaction the regu-

lations which the university of Oxford has made to encourage higher standard of education among that part of the youth of the kingdom hitherto unconnected with the universities."

The *Rev. Harvey Goodwin*, late Hulsean lecturer, Cambridge, recently appointed dean of Ely, writes, "For my own part, I have long reflected upon the condition of middle school education in England, and the necessity of bringing it to a higher standard. * * * * I apprehend that what is called middle education might be benefited by a system of university examination. In so saying would especially guard myself against being supposed to imply that by such means it would be possible to communicate to the middle classes the peculiar advantages of Oxford or Cambridge. No examinations can be a substitute for *residence*; and those features of university life, which chiefly make Oxford and Cambridge what they are, and to which you and I probably look back as among the most blessed influences ever brought to bear upon us, must still be reserved for those who are able and willing to give several years to unbroken university study. But because we cannot give all, we need not hesitate to give what we can; and while residence must be confined to comparatively few, the benefits of examination may be conferred upon a multitude. * * * : But what will the universities themselves say? or rather what will Cambridge say? for that is the question to which you expect me to give an answer, and to ask which you took the trouble of paying our university a visit the other day. * * * Judging from the general spirit of the place, I believe that the proposition for carrying out some such plan as that which you have brought before us, would meet with great favor. * * * We want something which shall endear us to the middle classes; we want something that shall make Oxford and Cambridge more than mere names in the minds of those classes, and prevent them from being regarded as *merely clerical seminaries*; we want a wider field of action, in order to make even the work that we are doing at present more effective and influential."

Rev. Alfred Barry, M. A., late fellow of Trinity college, Cambridge, and now head master of Leeds grammar school, thus writes to Mr. Acland:

"It is with the greatest pleasure that I see the attempt to estab-

ish a system of examinations for middle schools, under the sanction of the universities. We have drawn up a petition from *Leeds*, stating our views on the subject. It has been signed by many interested in middle class education, and the number of signatures might very easily have been increased. I have not the slightest doubt that such a movement would be welcomed all over the country by all grammar schools, commercial schools, &c. as one of the greatest boons they could receive. * * * For the class attending these schools is most important, drawn as it is from the middle ranks of society, with a slight admixture of the classes above and below; and the schools themselves play a most prominent part in that fusion of classes which is the stability of English society. * * * Now the universities at present guide us very little. I have 200 boys, and yet do not send on an average more than three every year to the universities; nor do I think it likely this number will increase to more than six or seven, at the outside. The mass of boys go elsewhere, to what is called 'business' chiefly; and we have no means of showing whether they are well taught or not. Nothing could possibly help us more than the power of referring to 'honors' gained in examination."

Mr. Templeton, M. A. of the university of Aberdeen, and principal of a classical and commercial school in Exeter, writes:

"If the universities would sanction the scheme, and grant some honorary title to those who fairly come up to a fixed standard, a lasting benefit would be conferred on that class of the country which forms the backbone of English society, and on which the well being of the state mainly depends; from which the higher classes are often recruited, and on which the laboring population chiefly depend for their subsistence."

I have quoted freely from the account of the "Origin and Objects of the New Oxford Examinations," given by Mr. Acland, to show that the systems of education existing in England did not meet the wants of the large and influential class of its population which holds its wealth, and in a great measure controls the destinies of the nation. Of 200 boys in Mr. Adams' grammar school in *Leeds*, *only three on an average go every year to the universities*. The others go from the grammar school at once to "business." Now, can it be

supposed that if the universities supplied the education that was wanted, this state of things could exist? No adequate proviso had been made by the universities for the necessities of this large class of society, and hence they did not go there. No institution existed of a character suited to their wants, and hence those constituting the "backbone" of English society pass from the grammar school to business—and therefore these head masters pray that before they enter upon the practical business of life, the universities may take care, by examinations under their appointment, and accompanied by their honors to successful candidates, that they go to their work with the education suited for it. If the boys will not go up to the universities, let the universities come down to the boys and thus provide and regulate the education which is demanded for them.

But I quote the pertinent language of the Oxford examiner, Mr. Acland, on this point:

"Time was when Oxford and Cambridge possessed a virtual monopoly of the higher branches of education, and commanded the entrance to the chief posts, not only in the church, but also at the bar and in medicine. This is no longer the case. To the causes of the change, whether within or without the universities, I need not refer in detail; one, however, is germane to the matter in hand—the growth of physical science in manufactures and locomotion."

"This has told both on the universities and on the nation.

"The first consequence has been, that the comfortable maintenance, inaccessible within the universities, has been often supplied to scientific men by boards of directors and trading companies.

"The second, that a new form of social influences has sprung up in the metropolis and elsewhere. Science has supplied the common ground on which the noble, the divine, the philosopher and the engineer have been glad to meet, whether at the soirées of the aristocracy, at scientific societies, or in social clubs.

"Concurrently with the spread of new intellectual and social influences, the world has been gradually finding out one deficiency

which not only prevails in the ranks of practical men, but even affects some grades of the professions. I refer to the want of a *good general education* as a preparation for scientific and commercial pursuits.

“In proportion as Oxford and Cambridge have seen the necessity of giving a more prominent place to natural science in the complete education of an English gentleman, practical men have been learning the value of classics and mathematics. The world knocks at the door of the schools and of the senate-house, and asks for help to guide its children in general education. * * * *

“The recognition of this actual state of facts is a great part of what is asked for at the hands of the universities. I contend that Oxford has acted wisely in granting the request with a good grace, *and in putting itself in harmony with the generation on which it is bound to act*; and that it may reasonably hope to strengthen thereby its power of doing good.”

The tendency of this great movement, and the character of the existing educational want, may be still more fully seen in the wide range given to the subjects of the middle class examinations, and in the arrangements presented for the great prominence assigned to *art* as an important branch of liberal education.

EXAMINATION OF SENIOR CANDIDATES,

(*For the Title of Associate of Arts.*)

- I. All candidates will be required to satisfy the examiners in
 1. Analysis of English sentences and parsing, and correction of faulty sentences.
 2. A short English composition.
 3. Arithmetic.
 4. Geography. Every candidate will be required to draw from memory an outline map of some country in Europe, to be named by

the examiners, showing the boundary lines, the chief ranges of mountains, the chief rivers, and the chief towns.

5. The outlines of English history—that is, the succession of sovereigns, the chief events, and the characters of the leading men in each reign.

II. The examination in rudiments of faith and religion is not required of any candidate whose parents or guardians shall have declined it on his behalf.

III. Every candidate will also be required to satisfy the examiners in two at least of the sections marked A, B, C, D; or in one of those four, and in one of those marked E and F.

Section A—English.

This will include questions in

1. English history, from the battle of Bosworth field to the restoration; and the outlines of the history of English literature during the same period.

2. Shakspeare's King Lear and Bacon's Essays.

3. The outlines of political economy and English law. The examination will extend beyond the subjects treated of in the first book of Smith's Wealth of Nations, and the first volume of Blackstone's Commentaries.

4. Physical, political and commercial geography. A fair knowledge of one of these four classes of subjects will enable a candidate to pass in this section.

Section B—Languages.

1. Latin. 2. Greek. 3. French. 4. German.

A fair knowledge of one of these languages will enable the candidate to pass in this section.

Section C—Mathematics.

1. Pure mathematics.
2. Practical mechanics (including mechanism) and hydrostatics, mathematically treated, surveying and navigation.

Algebra to the end of quadratic equations and four books of Euclid, will enable a candidate to pass in this section.

Section D—Physics.

1. Natural philosophy. Great importance will be attached to good mechanical drawing.
2. Chemistry. Questions will be set on the facts and general principles of chemical science. There will be a practical examination in the elements of analysis.
3. Vegetable and animal physiology. Questions will be set on vegetable physiology in general, and on the functions of vertebrata in animal physiology. Parts of plants and bones of vertebrata will be given for description. Great importance will be attached to good botanical and anatomical drawing.

A fair knowledge of one of these classes of subjects will enable a candidate to pass in this section; but in all cases, a practical acquaintance with the subject matter will be indispensable.

Section E—Drawing.

1. Drawing from the flat, from models, from memory, and in perspective, and drawing of plans, sections and elevations.
2. Design in pen and ink, and in colors.
3. The history and principles of the arts of design.

A fair degree of skill in free hand drawing will be required, in order that a candidate may pass in this section.

Section F—Music.

1. The grammar of music.
2. The history and principles of musical composition.

The elements of thorough bass will be required in order that candidate may pass in this section.

In the above programme, it will be seen that much prominence is assigned to the position of *art*. The views of Mr. Acland are so important in this connection, that I am sure no apology is necessary for presenting them in full.

“In every country which has reached an advanced state of civilization, the right mode of cultivating the arts, and of educating the designer and the workman, must sooner or later engage attention. We appear to be arrived in England at a crisis on this subject, from which we must go forward or backward.

“I understand by the term *art*, not merely the *fine arts*, but what are commonly called useful and ornamental arts, especially those which are in any way connected with beauty, form, color or sound. If we set aside those arts which relate to the provision of food, how large a proportion of the middle classes are concerned in making, buying or selling what may minister to the sense of beauty or the reverse? House building, with all that it involves in the way of decoration, exterior or interior, and furniture, and the supply of clothing, must ever occupy a large portion of our population, to say nothing of the minor arts which minister to personal ornament, or to the multiplication of the works of the artist. On merely utilitarian grounds, it is of the utmost importance to the commercial position of England, that she should not be outdone by foreigners in matters of such general demand. But in order to this end, *art* must find its place in national education, *by the side of literature and science*. If the artist is to design and the workmen is to execute, there must be a discerning public to appreciate the good and discourage the bad.” * * * *

Mr. Acland then proposes :

“ First—To recognize art as one branch of a liberal education, by the side of literature and science.

“ Secondly—To give the artist facilities and encouragement for the general cultivation of his own mind. * * * *

“ The practical difficulty seems to be of two kinds: 1st—that the principles of art are so vague that they are difficult to state, and still more difficult to learn except by practice; and, 2dly—that few have time both for art and for general education.

“ These difficulties are not to be lightly disregarded; nevertheless, it may still be true—1st, that a system of education which ignores the principles of art, is incomplete; 2dly, that an artist, who is a mere self-taught worker, would in all ordinary cases be the better for a knowledge of what others have done before him, and for instruction in the facts with which he has to deal—in other words, that he needs literature and science for the full development of the gift which nature has implanted in him.

“ As to the first point—It may be taken as now generally admitted, that literature, especially poetry, is of the first importance in the early stages of a liberal education—that it awakens power, gives vitality, and freedom and versatility to the mind, for the absence of which, especially in those who are to act on the minds of other human beings, nothing can compensate. Secondly—That an exclusive cultivation of a literary taste, with a neglect of science, leads to a narrow fastidiousness, and robs a man of innumerable opportunities of interest in the laws of the world in which he lives, and in the work of his fellow-creatures. The value of science, both mathematical and physical, as a means of giving strength to the reasoning powers, accuracy and concentration of thought, and scrupulousness in the examination of evidence, will not be denied at the present day by any one who, with a desire to hand down unimpaired the work of our forefathers to future generations, has taken an interest in the expansion of the educational system of England. But while literature fosters vitality, and science, accuracy—the one, submission to great laws, the other, a freedom which rises above

slavery to system—it would seem that *art* occupies a position between the two, and preserves, like poetry, the vital union of the imagination and reason; and as art manifests itself not in book nor in systems of thought, but in works, the study of the world which great men have produced must bring a valuable contribution to a complete education. In one sense, art finds its expression in the constructive tendencies of children and in the games of boys; and so nature calls into play invention, judgment, experience, and puts knowledge into practice; and some youths thus gain education from what they do as sailors or soldiers, or even from the activities or failures of the cricket-field or the hunting-field, which they never gain from books or lectures. It may be a question whether any system of education which does not provide for spontaneous activity, except as an excrescence or irregularity, can be right. Whether and in what way the practical arts can be made to bear their part in a liberal education, is another question; but clearly they must be taken into account in some form in dealing with middle class examination, and therefore must not be neglected by those who undertake the responsibility of guiding it."

These views are enforced by arguments from Rev. F. Temple, late fellow of Balliol college, Oxford, and one of the inspectors of public schools, Dr. Acland, reader in anatomy in Oxford, and from John Ruskin, Esq. and other artists of England, in communication which Mr. T. D. Acland has introduced into his "Account of the Origin and Objects of the New Oxford Examinations." They are in a high degree suggestive, as showing the tendency of the public mind in England as to what constitutes a liberal education.

The middle class examinations, thus established by the two leading universities of England, were commenced for the first time just as I reached England. To judge of the manner in which this important movement was received by the public, I copy from the *London Times* extracts from the proceedings of the public authorities at two of the principal *centres* of examinations.

The city of *Bath* was selected as one of the places for conducting the examinations under the Oxford statute. A large meeting was held in Guildhall in that city, under the presidency of the mayor, to receive the examiners for that district. The mayor having stated the object of the meeting, and expressed the satisfaction he

elt at the number of candidates who had presented themselves from the schools of Bath, one of the magistrates of the county moved a resolution tendering "most cordial and respectful greeting to Mr. T. D. Acland, D. C. L., and Rev. S. G. Ward, on their visit to Bath as representatives of the University of Oxford, on this occasion of the first New Oxford examinations in that city." Before putting the resolution, the mayor said, that "the term *middle class* examination had been used very extensively in reference to the proposed examinations, and had been very prejudicial to the movement. The examinations were not intended for any particular class, but to be applicable to all young men who were not members of the university." The resolution was carried by acclamation. Mr. Acland then addressed the meeting at considerable length. After acknowledging the greetings with which the delegation had been received, he said: "Their appearance in the garb in which they presented themselves (the Oxford gown), and the ceremony with which they commenced this first examination, showed that it was not regarded by them as an affair of to-day, but as a great national proceeding, which was not to terminate with their individual action. The history of the progress of the human mind in England was associated very closely with the history of the universities; and if they went back to the origin of the universities, they would find certain great practical influences always going side by side with the training in learning therein obtained. The two great professions which took care of the health and property of men, were proofs of this. *In this age, it had become evident that the ancient universities, so long as they continued to abide on the primary education of language and the abstruse sciences, would be unable to grasp the requirements of these two great professions.* In our day also, there were other callings fast rising into the importance of professions, and it also became of vital interest to England that our ordinary retail shops should be united with the higher intellectual attainments, especially in the decorative departments of art. Agriculture, too, was daily becoming more closely connected with science. It became of great importance that these interests should not grow up without connection with the old institutions of the country and sound learning. He was not going to enter into a controversy as to what were the elements of sound learning. They lived in peculiar times; and though he was far from considering forms unessential, yet the university of Oxford in this movement considered that it was possible for ancient forms to

be abolished, and for the reality to become stronger by the change. In these examinations the university proposed to test the success of the education any young man had received, who was not likely to pursue a university training. The system was therefore particularly designed to meet the wants of those who were likely to enter upon the practical business of life as young men."

At *Leeds* a similar meeting was held, at which *Professor Owen*, president of the British association, proposed the following resolution—"That the thanks of this meeting be given to the delegate (Rev. Dr. Hook), and to the examiner (Rev. C. P. Chretren), who presided over the late Oxford examination." After taking the opportunity of expressing, on behalf of the British association, their great satisfaction at all the arrangements which had been made for their meeting (the British association held its annual meeting in *Leeds*), this learned professor said, "that he had peculiar pleasure in proposing that vote of thanks to the Oxford delegate and examiner, because of the recent addition to the Oxford system of education, which had brought natural history, physiology, and indeed the whole range of inductive sciences, within the scope of the teaching of that ancient and honored university. Prior to that addition, the chief characteristic of the teachings of Oxford was the high degree in which the dead languages were taught, and the perfection to which the thinking faculties were brought by the dialetics taught in the universities. And, no doubt, to give to man the faculty of clear and profound thought, and the elegant patterns of ancient language in which to express the result of that thought, was one of the most important branches of education. It was only the exclusive direction of the aims of the university to that line of perfecting man's intellectual nature, to which any objection could be made. There was, if he might so speak, something of the element of selfishness in it, because it regarded man as too much insulated and distinct from the nature around him, with which he had really an indissoluble relation and dependence, that never could be ignored without some evil following. It was a feature, and had exclusively been the feature of the universities—Germany, for example—to consider man not only in relation to his own intellectual faculties and power, but in relation to the nature in which he was placed. Henceforth there would be no longer a distinction between the teachings on the continent and in England. He knew that a knowledge of

many branches of natural history, which the prince consort derived at the university of Bonn, had enabled him to sympathize with and enter into the views of Englishmen desirous of promoting science in a way he otherwise could not have done. If the peculiar character of England in relation to the rest of the world were considered—if, for example, there were a marked distinction between England and Germany, it was that one country had no colonies, and the other had an enormous amount of the surface of the earth in that relation with her; and, therefore, what country in the world was more concerned in giving her children a knowledge of the riches of the earth—of the character of the vegetation which grew upon that earth—their qualities in relation to food—in relation to the blood, and in relation to medicine—a knowledge of the properties of the whole world, and the characteristics of the external nature about them—what country, he asked, was more concerned in, or could get a greater and a quicker reward for such teachings, than Great Britain?

* * * If he took, for example, our great colony of Australia—how long was it before its mineral wealth was even suspected by the number of intelligent, active, energetic Englishmen who were inhabiting it? The discovery of *copper ore* at Burra-Burra was a mere accident—the abundance and richness in which the copper was deposited fairly forcing itself upon the attention of one individual. It was entirely an accidental discovery: and much of the advantage of that productive mine of mineral wealth had really been lost to the state, because there was not one young geologist ever sent out to study scientifically and rationally the mineral qualities of the colony, and the existence of the metal was long overlooked. Some years afterwards, a still more valuable metal was discovered in Australia, not by sending out any young person acquainted with the rudiments of mineralogy, which would have led him at once to see evidences of the highly probable existence of gold beneath the surface, but by an active, energetic gold-seeker, who after being in Australia, had gone to California, but not succeeding there as well as he expected, he returned to Australia, and in traveling through it, he was struck with how much many of the features of the country were analogous to those of California, where he had sought for gold. It was thus that Mr. Hargreaves made the first practical discovery of gold which had since so extensively developed itself in Australia.

* * Another instance bearing on this point he could not help mentioning. The universities of Scotland had preceded the English

universities in that more extended curriculum of instruction; and it was just because *Livingstone* had attended the classes of different natural sciences in Glasgow, and because during the brief period he tarried in London, 18 years ago, before going out to his high mission in South Africa, he availed himself of the museums in London to improve his natural knowledge, that he had been enabled to make his wonderful journey in Africa so truly profitable to science and to mankind. He stood almost alone as an example of a scientific traveler in Africa, by reason of that preliminary knowledge of nature which he carried with him."

The views of Professor Owen are strikingly applicable to our own state. What an immense undeveloped territory does Virginia present, with stores of mineral wealth waiting for the exploring hand of the man of science! And how much has been lost to her and to the whole country, for the want of just such a kind of educational training as he points out! Our mines of coal, salt, iron, lead and gypsum have really forced themselves upon the attention of those who scarcely knew their presence or their extent; and the practical skill of *Edmund Ruffin* alone unlocked the riches of our *marl beds*, while science in our educated men was fast asleep.

In tracing the rise and progress of this great movement in England, the *results* of these middle class examinations must not be overlooked, for they have much significance, and are worthy of attentive consideration.

It appears that out of *eleven hundred* of the middle class scholars of England, who were candidates for honors under the New Oxford statute, *upwards of seven hundred were rejected*. But this is a parable only, and a very small part, of the truth. These *eleven hundred* were of course the *élite* of the various schools which they represented. With such a result in the case of the *candidates* for honors, what, of necessity, must be the state of those who have been passed by and not examined? The former count by hundreds; the latter may be enumerated by thousands—and these belonging to a class forming the very "*backbone of English society*." And on what account were these candidates for honors rejected? The Right Hon. M. T. Barnes in his speech at the public meeting at Leeds, just noticed, show why.

"When it was remembered that the great want of success had been caused by failing in such matters as *orthography, writing, the first four rules of arithmetic, geography, and English history*, which might be properly considered as the most rudimentary parts of an English education, there was too much reason to fear that there was in certain schools a tendency, which it was to be hoped the effect of these examinations would be to diminish, year by year, to substitute for true, sound, practical knowledge, that which was only showy and superficial."

A writer in the *London Times* puts some pertinent questions on these results—"If the middle class schools have thus been found wanting, what, for any thing we know, is the condition of the great mass of those for the humbler classes? What even of those for the upper, both male and female, in the latter of which especially, mere fashion and frivolity so often set at nought nearly every thing that is either rational, elevating or useful?"

If the same tests were applied to the same class of schools in *Virginia*, would not the results be still more deplorable? There is much connected with this result that is not peculiar to England—such as "the tendency to make a traffic of education, and the negligence of parents in seeing that the means of instruction are actually possessed by the so-called schools, to which they send their children." The essential defects of the English school system, viz: *inefficient teachers and worthless text-books*, exist with us in *Virginia*, also. "Moderately educated young men, without professional experience, even graduates of whatever degree, fresh from the universities, are not necessarily qualified to act as teachers, any more than they are thereby qualified to perform a surgical operation, or to undertake the command of a brigade." The necessary consequence of such a system is the use of *text-books* suited to the qualifications of the teacher. Hence arises the class of "Manuals"—equally current in this country as in England—such as "Conversations in Grammar," "Conversations in Chemistry," &c. which, while they make a show of educating, they are only successful in obstructing. *

I conclude my reference to the New Oxford middle class examinations, by quoting a passage from a public speech delivered by

Professor Max Müller of Oxford, at a meeting held in Exeter, on the 18th of June 1857 :

"The university of Oxford has this day sanctioned the degree of associate of arts. It has broken down the ancient barriers which divided classical from practical learning. This is a revolution at which the most revolutionary professors of Germany and France will stand aghast. And if you look back to the history of the universities in Europe, you will admit that it is a revolution, that it is a great change, and, we may add, a sign of life and health."

Simultaneously with this important movement in behalf of the middle class education of England, measures have been taken to provide increased facilities for the instruction of more advanced youths in those departments of study now claiming more particular attention. Besides the addition made to the scientific branches taught in the university of Oxford, a national college has just been organized in *South Wales*, with special reference to the wants of the nation and of the age. This institution has unfolded its system of education in a neat little volume, in which the "*Principles of Collegiate Education are discussed and elucidated in a description of Gnoll College.*" I quote from this volume :

"The chief continental states, wisely alive to the value of science in the development of national resources * * * &c., have already derived great benefit from institutions established for the purpose of qualifying young men, by systematic instruction, to distinguish themselves in professions, agriculture, mathematics, and in other operations connected with national enterprise.

"Public attention in the United Kingdom has been frequently directed to this subject, especially since the great exhibition, and some attempts have been made to meet the demand already elicited. No design, however, of a sufficiently complete character, has hitherto been proposed, and the ground remains clear for the foundation of a college adapted to the wants of the age.

"The objects of *Gnoll college* are the comprehensive elucidation of scientific principles, and the practical application of science to the public service and to the chief branches of national industry.

“The instruction of youths who will have to direct the manufacturing, mercantile, professional and agricultural operations of the country, and who are the heirs of its property and capital, has risen a few instances beyond the inadequate routine of the old grammar schools and universities, now rendered comparatively inefficient by the rapid progress of education among the lower classes.

“The fact has also been publicly recognized by legislative authority, that a ‘manufacturing and mercantile, has arisen by the side of a faded aristocracy, and is exercising great influence on the public councils;’ and it may be doubted, on the same high authority, whether the intellectual wants of either of those elevated ranks are met by the patented and almost worn out’ routine of the old systems; indeed, it may be safely asserted, that such is not the case, and, if need be, abundant proof will be cited to support this assertion.

“Coming events are at length sufficiently foreshadowed to convince the majority of thoughtless men of the immediate and pressing necessity for sustaining the influences of superior wealth by superior intelligence; and on this account alone, if other motives were wanting, inducement enough is to be found for the prompt establishment of a vigorous system of scientific and practical education for the wealthier classes.

“A main cause of the misapprehension that has recently confused the public mind, in its laudable endeavors to grasp this question, may be traced to the neglectful and inefficient state of the universities.

“The associated colleges which constitute these still great and famous corporations, having, according to the highest authorities, failed to satisfy the wants of the age, the energy of the nation, unquenched by stubborn resistance, has in many ways undertaken to reshape itself. The great efforts of the society of arts afford a long series of successful instances.

“The originators of the present scheme believe that colleges for completing the education of youth, and fitting young men for the pursuits of mature age, should be distinguished from the seats of the special professions.

"That which the inns of courts might be for lawyers; the colleges of physicians and surgeons, the apothecaries' hall and the hospitals for the medical profession, the universities *might become* for theologians and philosophers.

"To this point indeed the universities are rapidly tending; and the greatest benefits might be expected from an adaptation of these famous establishments to objects of this lofty character. At present, according to the report of the Oxford university commissioners, '*The education imparted there is not such as to conduce to the advancement in life of many persons, except those intended for the ministry of the established church.*'"

With these views of the national importance of their enterprise the originators of Gnoll college, encouraged by the support of some of the most learned men of the kingdom, among whom may be mentioned *Bishop Thirwall* and *Rev. W. A. Conybeare*, present the following scheme of instruction:

Introductory Course.	Examples of Intermediate Courses.	Examples of Final Courses.
Mathematics,	- Descriptive Geometry; Higher Calculus.	Astronomical Observat'ns; Trigonometrical Surveying.
Mechanics, Physics,	- Materials of Machinery. - Investigation of Natural Forces.	Mechanical Arts. Steam; Projectiles; Tractric Navigation.
Chemistry,	- Chemical Analysis; Mineral Chemistry; Organic Chemistry.	Chemical Manufactures; Agricultural Chemistry; Sanitary Science.
Natural History,	- Geology; Vegetable and Animal Materials.	Mining and Metallic Manufactures; Vegetable and Animal Growth, and Manufacture.
Human History,	- Languages and Music; Psychology and Logic; Sacred and Civil History.	Jurisprudence; Administrative Diplomacy; Commerce; Poetry; Letters.
Design,	- Optical and Photographical Representations; Drawing and Painting; Lithography; Engraving; Carving; Modeling; Sculpture.	Constructive Arts; Formative Arts; Delineative Arts.

It is intended that the student shall pass through all the seven *introductory* courses. The special pursuits which each student has in view will govern the selection of the *intermediate* subjects; for it is not contemplated that any mind can perfectly grasp the whole, although the influence of the entire range of studies will doubtless

e generally felt. The speciality of each student will engross his attention in the *final* series.

That there is good ground for anticipating success in such an enterprise, the friends of the scheme quote the following language from the report of the Oxford university commission :

“Many persons expect that such a school, when once recognized as an independent branch of academical instruction, and supported by eminent professors in all its departments, will, from the tendency of the age towards the pursuit of material knowledge, be likely to assert its own importance, and they (the commissioners) think therefore that to insure success, no more will be needed than to give it independent existence, and full scope for action, without making it compulsory.”

The Oxford commissioners signing this report, embraced, among others, the present Bishop of London, the Bishop of Norwich, and Rev. Baden Powell.

These opinions are impressed as convictions on the minds of the originators of Gnoll college. And when it is considered through what difficulties men of genius in Great Britain have had to struggle, without the aid which a suitable education would have afforded them ; that her best engineers have received no other education than that which results from habitual encounter with difficulties ; that *Brindley* was first a day laborer, afterwards a working millwright ; *Telford*, a working mason ; *John Rennie*, a farmer’s son apprenticed to a millwright ; and *George Stephenson*, a brakesman and engineman,—can any one doubt the success of an enterprise which looks to the wants of this large and influential class of the working part of a great nation.

This sketch of the present movements in Great Britain for the modification of its educational system, is not without special interest to this school. It confirms, by the experience of a great nation, now arousing itself to some adequate provision in education to meet the demands of its people, the policy which has marked the past history of this institution, and is of sufficient significance to give the fullest encouragement to it, in its future development.

It shows that the education demanded by the agriculturist, the merchant, the manufacturer, the engineer, and, in general, by those whose position, whether as large landed proprietors or monied men, exercises a commanding influence in the destinies of the country, is not met by the "worn out routine of the old systems" on the one hand, nor by a restricted *technical* course on the other, but must be at least as *liberal*, although of a different kind, as that provided for the so-called *learned professions*; and finally, that *art* is pressing its claims to public attention, as an essential element in liberal education; not only from its intimate connection with trade and commerce, but from the important office it discharges in developing in their true harmony the faculties of the human mind.

If these views be correct, and I have no doubt that they are, it follows, that special schools of application like that for the agriculturist at Hohenheim, or for the civil engineer at the "Ecole des ponts et chaussées," Paris, would not meet the wants of these great interests either in Great Britain or this country, unless the youth entering them had first received the advantages of a preparatory course of liberal general education. Nor would such a preparatory course as that given at the polytechnic school, Paris, be sufficiently liberal or general for these purposes. The wants of this country as well as of England (for the free institutions of both countries place them in circumstances to make the same principles applicable to both), include, as essential parts of such a liberal education, those branches which instruct young men in the performance of their duty as *citizens*, and which cultivate a knowledge of those principles which concern the rights and privileges of a *free* people; and therefore, any preparatory course which did not keep the student in full harmony with the sympathies of the country to which he belongs and upon which he is bound to act, would seem to be defective.

There are cogent reasons too, why the *preparatory* and *special* schools should be united in one establishment, as in the U. S. military academy at West Point, and as they are proposed to be in Gnoll college.

Economy of time and money is promoted by their union, while there is a great advantage in having the influence of the entire range of studies generally felt in the institution.

With the accumulated experience, then, of twenty years in the practical operations of this institution, and with the advantages derived from the experience of other countries, I think we may very satisfactorily define its future policy, so as to prepare it, in a prominent degree, for the sphere of usefulness already marked out for it as a *general scientific school*.

Its *preparatory* course of studies is general and liberal for any of the *specialities* embraced within its range. It comprises *Mathematics*, *Languages*, including *English*, *Latin* and *French*, *Chemistry*, *Physics*, *Drawing* and *Geography*.

For some of the *special schools* comprehended in a general scientific institution, it has already in operation a well defined course of studies. For the *soldier*, there is provided a liberal course of military instruction, theoretic as well as practical. For the *civil engineer*, *architect* and *draughtsman*, the course of civil engineering, drawing, mineralogy and geology and mechanics, supplies a basis upon which this special school can with ease be indefinitely extended and perfected. For the *agriculturist*, the accompanying report of Major Wm. Gilham, prepared during my absence, and at the suggestion of some of the leading agriculturists of the state, and which most fully harmonizes with the general scheme herein developed, presents a detailed outline.

And, in like manner, there is not a specific demand that can properly be made upon this school, whether from the manufacturer, the miner, or the mechanician, that cannot readily be supplied by an accommodation of its instruction upon the basis already existing for the special necessities of these interests—while the general range of the whole system of studies will be just such as is required for all those who expect to become *practical men* or *men of business*.

Nor should I omit to mention the special preparation which a school thus organized necessarily gives to the *professional teacher*.

Independently of the peculiar fitness of those for *teachers* who are trained under its peculiar system of discipline, and who are daily *drilled* in their studies, in small sections, by laborious catechetical instruction, the practical elements of the school, in its extensive

laboratories, museums, and model rooms, would present special advantages for this important profession.

And finally, could the *artist* seek a more desirable field for preparatory or special study than could be provided for him here? Nature lends her inspiration to him in all the beauty and grandeur of the scenery around him, and he only needs the opportunity to study the models of the great artists of ancient and modern times to enable him to develop the gift with which he may be blessed.

What, then, is there to prevent this institution from becoming a great school of applied science for our state and for the whole country? The line of duty seems plainly marked out before it; the field is open and unoccupied; and the command comes with significance at this time—**Go FORWARD.**

I would not be understood to intimate by any thing that I have said, that this institution should at once occupy the expanded sphere thus sketched out for it, or that it was prepared to do so, or that many years may not elapse before it shall have reached its fullest usefulness in all of these various lines of duty. But I do say, that so far as its means may allow, its course of instruction and its general arrangements should be at once placed in harmony with the great mission before it—that it should perfect itself more and more in those branches of study now embraced within its programme, and thus be in a state of *preparation* gradually to unfold itself to the wants of the age and of the country. .

I would take the liberty of specifying some of the ways in which this preparation may be made:

1. Its standard of scientific instruction should be elevated. The academies and high schools of the state are now giving a better scientific education than the colleges did twenty years ago. The material coming into this institution is better prepared than it formerly was, and our graduates are pressing upon our steps, and demanding higher and higher standards. We see thus the double influence upon education. The elevated grade of instruction in the lower schools now reflected back upon the higher with the material supplied for still upward progress.

2. The course of experimental philosophy should be extended, and the course of engineering and mechanics specially adapted to machines.
3. *Model rooms* should be provided for implements, machines, models, and works of art; and *museums* established, in which, among other things, should be exhibited for instruction, specimens of forest timber, soil, seed, wool, cotton, tobacco, and other natural productions.
4. *A large hall* should be provided for public and popular lectures; and it should be made the duty of the professors to deliver stated periods, and in a prescribed order, a course of popular lectures on those branches of science embraced in the programme of the school, especially on those which relate to agriculture and the arts.
5. I think the range of studies in *modern* languages should be extended, so as to embrace *Spanish* and perhaps *Italian*.
6. The course of moral philosophy, constitutional and national law, should be extended, and instruction given in political economy.
7. More attention to be paid to *English studies*. Our free institutions open ways of usefulness to an educated man as a public speaker and writer, that ought not to be forgotten nor neglected. I have shown, too, what attention is paid in the scientific institutions of Europe to the preparation of *memoirs*. The *engineer* would be but poorly fitted for his work, who could not prepare an intelligible report.
8. A digest of modern history should be taught.
9. And finally, facilities should be at once provided for the admission of young men from other states.

To secure these important objects, three additional professors and building fund will be required.

By thus placing the institution distinctly upon its specific field of

labor, it would become an important auxiliary to the other institutions of the state, and would receive from them, I have no doubt, hearty support, while it would be building up within our own commonwealth a special school of general applied science, the influence of which would be felt upon the state and upon the country.

I cannot doubt the ultimate success of such a scheme. It may be delayed for want of means; but the onward and upward spirit which has placed it in its present position, will still press it forward to higher and higher fields of usefulness, until it has reached the summit of the proud destiny that awaits it. Let us do our part now, and the generations following will reap where we have sown.

I cannot close this report without expressing my great obligation to the acting superintendent, Major J. T. L. Preston, who, at much personal discomfort and sacrifice, assumed the duties of my office in my absence. The laborious fidelity with which he has discharged these new and trying duties, left me nothing to do on my return but to continue the operations of the school just as I found them in his hands.

I have the honor to be,

Very respectfully,

Your ob't serv't,

FRANCIS H. SMITH,

Superintendent

MAJ. GILHAM'S REPORT.

VIRGINIA MILITARY INSTITUTE,
JANUARY 8, 1859.

COL. F. H. SMITH, *Sup. V. M. I.*

SIR,

The course of instruction in this institution is mainly a scientific and practical character, wisely designed by the board visitors to fit young men for the practical pursuits of life. Agriculture is the leading occupation of the people of Virginia, and of the south; that one upon which depend all other pursuits, and which affects the prosperity of even the state itself. A large majority of the young men committed to our care, are the sons of farmers, many of whom leave our walls to take charge of farms, while any others sooner or later become tillers of the soil; therefore, it appears reasonable that provision should be made for agricultural instruction. Having given not a little time to the consideration of agricultural education, and having satisfied myself of its great importance, and of the practicability of introducing a thorough course in this institution, I beg leave to submit my views upon the subject, and to request that you lay this communication before the board of visitors at its next meeting.

Almost every where, at the present time, the prevailing sentiment is in favor of agricultural colleges and schools, and such a sentiment is quite prevalent in Virginia and the other southern states. There are those, however, who, decrying every thing which is not "practical," cry out against "book farming," without thinking that perhaps the young farmer might derive something of the same sort of benefit from a *professional* education suited to his wants, as the lawyer, the divine or the medical man does from his. There can, I think, be no reasonable doubt that agricultural schools, if properly organized, would accomplish great good; and I shall take

but little time in any argument to demonstrate this. Engineering is eminently a practical pursuit. The engineer may and generally does commence as an humble assistant, and gradually works into the higher walks of the profession; and yet it is universal assumed that the engineer, if he hopes to master his profession all its details, must, before entering upon it, be thoroughly ground in all the arts and sciences upon which engineering depends. In other words, his education must be more or less special—professional. Agriculture, while a practical pursuit, is not a whit more so than engineering. Schools for engineers are considered necessities, and are patronized. Why, it may be asked, are agricultural schools less necessary, or less likely to be sustained? If the farmer is to dignify and adorn his occupation, and at the same time keep pace with the age, should not his education have as much of a special bearing as that of the engineer?

The best argument in favor of the utility of agricultural schools is to be found in the fact that but few years have elapsed since schools of this kind were very rare, almost untried. Now, they may be counted by the hundred, and their numbers are still increasing. In Europe, the agricultural school is no longer an experiment. It is, if we are to believe the reports which reach us, a accomplishing great good. The most renowned and probably the model school, is that of Hohenheim, for an interesting account which I am your debtor. The others most noted are at Cirencester in England, Gignon in France, Moglin in Prussia, and Gorey Gore in Russia. In 1850 President Hitchcock of Amherst, Mass. enumerated 350 agricultural institutions in Europe. Since that time they have greatly multiplied, so that it is estimated that at the present time their number is not far from 500; and by far the greater number of them are the creations of the last twenty years.

The agricultural college of Cirencester, England, is probably more nearly suited to our wants than any other. This institution has been in operation but a very few years, and is already doing efficient service, if we may be allowed to judge from the valuable contributions to scientific and practical agriculture which emanate from its faculty, and which are coming to us in almost every number of the Journal of the Royal Agricultural Society of England.

In our country, while very much has been said upon the subject

Very little has yet been done towards the organization of agricultural colleges and schools. A commencement has been made, however; several agricultural colleges have been organized; and we may hope that schools of this kind, suited to our wants, will multiply with the same rapidity that they have in Europe.

While there appears to be but little diversity of opinion in relation to the utility of agricultural schools, there seems to be no little difference of sentiment as to what range of subjects a course of agricultural instruction should embrace, and the manner in which instruction should be imparted. Almost all of the institutions yet organized are located on farms provided for the purpose. Very much of the instruction is of a purely practical nature—the field taking the place of the lecture room, and the students being required to take part, not so much in the management as in the manual labors of the farm. Such a system may be very efficient in the education of young men for managers, stewards, &c. as most of the agricultural schools are designed for, but I cannot think that it would meet with favor in Virginia or the other southern states, or that it is desirable it should.

The young men of the south who would seek the benefits of an agricultural education, belong for the most part to that class who have means, who would, if not taking a special course, take the ordinary collegiate course of the country, and so soon as their education was completed, enter into the possession of their estates, to direct all farm operations, establish rules for the government of servants, &c. for themselves. Our first efforts, therefore, should be to establish such schools as would be required for the education of the proprietors of the landed estates of the country—men who stand in the same position, socially and politically, as the members of the bar or of the medical profession. This being the case, it is not to be expected that we can find in any existing school a model for our guidance; nor indeed is such a model necessary. We live under peculiar conditions and must organize schools suited to our peculiar wants.

Our agricultural system is peculiar, and must be so, as it is modified in very many of its details by the institution of domestic slavery. All or nearly all farm labor is performed by the slave. The master

must direct him, or have him directed in nearly all that he does. Law and the common dictates of humanity impose important duties upon the master—at the same time that his own interests demand that the labors of the slave, while they are not too severe, should be constant and productive. The farmer in a free state, who requires labor, hires it when he wants it, and of such a character as he may most need. When no longer needed, or when not suited to his wants, his hands are discharged, and he obtains a new supply, or waits until the changing seasons bring around the period for more active labors. The southern farmer, however, having the slave from the cradle to the grave, must support him in unproductive youth and in advanced age, and must so direct his labors when he is an efficient laborer, that no time shall be lost. In season and out of season, the master must find profitable employment for him. Added to this, there are moral responsibilities resting upon the master which cannot be shaken off, or transferred to another—responsibilities which are unknown in free society.

Again: The productions of our climate differ in many respects from those of Europe, or even our own northern states; and consequently, while the great principles of agriculture are the same every where, our system is materially modified on this account, and our instructions should be in accordance with this modified system.

We need, in the first place, a school of the highest order—one in which the young farmer may acquire as complete an education suited to his wants as a professional man, as the lawyer and physician do in theirs, respectively. If we are to advance in agriculture we must put it upon the same ground, educationally, that the professions, or I may say, the other professions occupy. Our young men must be taught to feel that there is in agriculture as much to call forth all the energies of the mind, as in any other pursuit whatsoever; and in educating them for it, the course of instruction should be so framed as to give the mind full expansion in that direction.

But while the farmer's education should be for a special object, and consequently take a special or professional turn, it should not be too technical. He is in a position to exert a commanding influence, and owes certain duties to society, which can be better dis-

charged by his having a knowledge of many of the more important branches which constitute a part of the ordinary collegiate course. We may give young men the college course, to be followed by one purely professional, or we may so arrange a course of instruction for four years, as to include the special in the general one. By the latter arrangement, the student would master the principles of his profession, while he was also acquiring those branches which are deemed necessary to every educated man. In the existing state of public sentiment in our country, there can be no doubt that the latter plan is the one best calculated to insure the desired object. The benefits likely to result from the introduction of agricultural schools, must be more apparent to the great mass of our people, before parents will be willing to give their sons a complete collegiate course, to be followed by an agricultural one. To secure the latter, the two must be combined, and this I propose shall be done by the organization of an agricultural department in this institution.

Our young farmers should be so educated, that they may with efficiency and skill direct the labors of others, rather than for the performance of manual labor themselves. We want scientific farmers—not mere laborers. We should aim to teach the principles upon which the plough is constructed—its various forms, uses, &c., rather than to make ploughmen. Not that I would entirely ignore practical instruction. On the contrary, I would make that a prominent feature. It is the very best means by which to illustrate important principles, and fix them in the mind. The agricultural student should have opportunities for becoming familiar with all of the operations of the farm; but it does not follow from that, that he should take any part in its actual labors. His office should be to *observe*, and receive instruction from those competent to give it, while the labors are going on, and not waste his time in the acquisition of a species of practical knowledge, that never could be of much service to him.

Again—While the student is acquiring those principles which are to guide him in his pursuit, he should be thoroughly imbued with the necessity for system, order and good government on the farm; to accomplish this, he should, in the efficient discipline of the school, have always before him an example at once of the necessity for, and the beneficial effects of good government. If he is edu-

cated to habits of order and subordination, we have the sure guarantee that he will, in after life, fully appreciate their importance, and be governed by their principles.

We come now to consider the special branches which should claim our attention in the education of young men for professional agriculturists. Our first aim should be to educate them in such manner that, when in the pursuit of their profession, they may be fully alive to the importance of observing accurately the phenomena of nature; and that they should be capable of classifying the observed phenomena, referring them to the principles upon which they depend, and of so reasoning upon them as to turn them to practical account. This can only be done by thoroughly grounding agricultural students in the principles of all the sciences which investigate the phenomena of agriculture, and by which its processes are conducted.

For example—the farmer meets with a great diversity of soil upon his farm, or he sees the soils of the region in which he lives are unlike those of another region. If he is familiar with the principles of chemistry and geology, he will not only know that these various soils had their origin in the rocks underlying them, but will be able to trace out the changes that have taken place in the rock to produce them, and by simple observation may learn much, very much of their composition, physical condition, probable requirements, &c. But if he is not familiar with the application of science to the explanation of agricultural phenomena, he may not know that the soil is formed from the rock which underlies it, or if his observation has taught him this important truth, it will be of no practical utility to him, for the reason that a knowledge of principles is necessary to correct reasoning upon the subject.

Again—By familiarity with the principles of science, the farmer will become an observer of, and turn to practical account, phenomena that might otherwise have entirely escaped his notice, even supposing him to be desirous of noting every thing worthy of attention. To use the example just cited, how many educated and enlightened farmers are there who have seen the rocks underlying their soils from their youth, without for once taking any account of the influence the former must have had in the formation of the lat-

er, and simply because they know nothing of the application of
eology to agriculture.

While the student was acquiring the principles of science applicable to his profession, the numerous details of practical agriculture should not be overlooked. This branch of the subject I leave to be discussed in another place. I do not wish it to be understood that by practical instruction I mean that any young man could be a thoroughly scientific and practical farmer, on the receipt of his diploma from the agricultural school. To promise any such thing would be preposterous. I would expect the professional education to do for the farmer what the medical school does for the physician, the law school does for the lawyer, or our national military school does for our officers.

The medical student is taught the principles of science upon which successful practice depends; he is taught what is regarded by the profession as the proper way to treat disease in all its forms; he is allowed to accompany his professors in their visitations to the hospitals, &c., in all of which he receives a large amount of practical instruction—and yet no one presumes him to be a finished medical practitioner when he receives his diploma. He has, however, such a foundation of scientific and practical knowledge, that when aided by diligence, experience and judgment, he may take a high stand in his profession. So in the agricultural school—we should expect to give the student such a course of theoretical and practical instruction, that when he enters upon the practice of his profession, his education may be of great assistance to him, enabling him to conduct his farm operations with greater skill, and consequently with greater profit to himself, at the same time that he would be setting a useful example to others, provided he, with diligence, energy and judgment, makes use of the knowledge acquired in the school, and of that which he acquires in the practice of his profession. His scientific and practical attainments can only be useful to himself and to others, if used aright.

I proceed now to enumerate the subjects which it seems to me it is more specially important to embrace in a complete course of agricultural instruction, without referring to those branches which belong in common to all liberal education.

1st. *Mathematics*.—It needs no argument to show the necessity for as complete a course of mathematics as is ordinarily taught in collegiate institutions. Besides the training of the mind to habits of correct reasoning, the student of scientific agriculture requires knowledge of mathematics in the prosecution of his other studies and in the practice of his profession will almost daily stand in need of more or less mathematical knowledge.

Surveying, which is properly an application of mathematical principles, should be taught practically. The student should learn how to survey fields and farms accurately, &c. He should be able to use the level and the theodolite, and be familiar with leveling in all its details.

2d. *Natural Philosophy*.—This should embrace, 1st, a full course of mechanics; the laws of equilibrium, and motion of solids, the equilibrium and motion of fluids, &c.; the available power of steam, water, wind, the horse, and man; the application of principles to the various farm implements, machines, &c. should all be fully discussed. 2d. A less extensive one on *meteorology*. Under this head the importance of regular observations of atmospheric phenomena to the agriculturist should be shown; the instruments in use should be explained; the formation of clouds, rain, snow, dew, frost, &c. the local and general causes which affect climate, the fall of rains &c. should also be discussed. 3d. The effects of heat, light and electricity, as mechanical agents, should also receive attention.

3d. *Chemistry*.—So much has been said and written about the benefits to be conferred by chemistry upon agriculture, or by “agricultural” and analytical chemistry, that many persons have supposed, and not a few have taught that scientific agriculture was nothing but an application of chemistry. That chemistry has conferred, and will continue to confer important and lasting benefit upon agriculture, there is no doubt; but no one who is familiar with its principles, and has a proper appreciation of the requirements of scientific agriculture, could regard it in any other light after all, than as *one* of a circle of sciences, all of which are necessary to agriculture as a whole.

The undue prominence which but a short while since was given

o chemistry as the one science which could throw light upon the farmer's path, taken in connection with the fact that designing men ave been systematically practicing upon the credulity of the pub-
c, and coupled with the additional fact that there are agricultural phenomena which chemistry has yet failed to elucidate, has led many at the present time to deny the utility of chemistry alto-
ether, or to place too low an estimate upon its value to the farmer. When we reflect that in nearly all the processes of improvement of the soil, such as manuring, &c. in the germination of the seed, the growth of the plant, the formation of fruit, and the after conversion of vegetable into animal matter, although influenced by heat and light, the changes are all chemical, no one it seems to me could doubt the propriety of, or the necessity for the scientific farmer being familiar with the principles of chemistry, and its applications to the explanation of the phenomena which come under his observation.

This course should be taught by recitations from some well digested text-book, with occasional lectures from the professor. A laboratory should be fitted up for manipulation, in which the students should be required, under the direction of the professor, to manipulate for themselves; to prepare, study the properties, and test the various substances embraced in their course. Having had some experience in this method of teaching chemistry, I unhesitatingly recommend it over the old method of lectures and illustration by the professor.

But while I would thus render the chemical instruction practical, wish it to be distinctly understood that I have no desire to make it appear that by this method I would expect to turn out "analytical chemists." The time given to the study of chemistry in any institution in our country, is, with a very few exceptions, too short to admit of a complete course of instruction in this branch of chemistry. Such instruction is not at all necessary. The farmer has to deal with *principles*. If, in the elucidation of these principles, he has occasion to call in the aid of analysis, let him go to the professional chemist; and if he is familiar with his subject, he can reason upon the results obtained by the chemist, as well as if he had obtained them for himself.

4th. *Mineralogy and Geology*.—The first of these sciences give us a knowledge of the composition and properties of the individual minerals which are found in the soil, and in the rocks which underlie it, and if properly taught, the student will be enabled to organize all the more commonly occurring ones himself. The second, treating of the formation and history of mineral masses, aggregated minerals, the origin of soils, the component parts of the various formations, the changes to which they have been subjected &c. opens up a wide field of useful enquiry to the farmer.

These sciences, to be practically useful, should be taught practically, as in the case of chemistry. In mineralogy there is no difficulty, as the student might be required to examine and test each mineral until familiar with it in all its varieties. In geology, too much can be done in the lecture room, by making the student familiar with the various rocks which compose the different formations, by causing him to study the characters of characteristic fossils, &c. But in order to make the instruction really practical, the student should have opportunities for studying the geology of the country around the institution, and of visiting interesting and instructive localities.

5th. *Natural History*—embracing botany and zoology. Under the head of botany, the course of instruction should include a complete outline of vegetable physiology, in which the offices performed by the roots, stem, bark, leaves, &c. should all be fully explained, and one of systematic botany, including separate descriptions of the various agricultural plants, and of the “blight,” fungi, &c. which are hurtful to cultivated crops.

The course of instruction in zoology should embrace a complete outline of animal physiology, the division of the animal kingdom into four great groups, the subdivisions of the vertebrates, with more particular account of the mammalia, including particular descriptions of the domestic animals, as the horse, the cow, the sheep &c. Under the head of invertebrates, the habits, transformations, &c. of insects injurious to vegetation should be discussed with the particular descriptions of those which more commonly prey upon the various crops of our country.

6th. *Engineering and Architecture*.—The first I would limit to the consideration of the various building materials, their relative strength, durability, value, &c. and the various processes of cutting and felling, making embankments, draining, the construction of common roads, farm bridges, &c. The course of architecture should embrace its principles, together with its application to the construction of the various buildings required upon the farm, from the mansion of the proprietor to the most unimportant structure. Economy, health, comfort and utility should be consulted in all cases. I would not expect the farmer, however, to take the place of the professional architect. On the contrary, the insight which he would get of the subject would be sufficient to show him the necessity for consulting the professional man in all important improvements.

Rural architecture has not received the attention in our country that it deserves. Our people need to have their natural tastes educated to a proper appreciation of its importance to a cultivated people; and I can conceive of no better plan for effecting this, than by securing a general diffusion of correct principles in the way proposed.

7th. *Right-lined and Topographical Drawing*.—This instruction becomes necessary in connection with surveying, engineering and architecture.

8th. *Medical and Veterinary Practice*.—The application of science to the investigation of the causes of, and the means of cure of the diseases of domestic animals, is justly regarded as a necessary part of the education of the scientific farmer; and we accordingly find that in the best agricultural schools provision is made for instruction in veterinary medicine. A course of scientific agriculture would not be complete without it. The instruction in this subject should embrace the structure and anatomy of the domestic animals, their diseases, mode of treatment, &c.

If such instruction is necessary to the educated farmer, in order that he may take proper care of the various animals on his farm, how much more necessary is it that the southern farmer should have some knowledge of the human frame, the prevailing diseases of the region of country in which he lives, and the ordinary modes of

treating them. He not only has the health of his immediate family to look to, but that of all his servants. On a large farm there must always be more or less sickness; and if no physician is on the place, there must be almost daily calls upon the master for medical advice. He must be something of a physician, in spite of himself.

In the education of the farmer, I would provide for instruction in human physiology and anatomy; the symptoms, &c. by which he may know various diseases—how to treat them; how the sick should be nursed, &c.

I would have it understood, however, that in proposing such a course of instruction, I have no idea of making a physician of the farmer. I would simply expect to qualify him for the better performance of the various duties which a proper care for his own interests and a due regard for the welfare of his servants, impose upon him. He would be competent to the skillful treatment of a simple diseases—would know how the sick should be cared for and would be sufficiently familiar with symptoms to know when he ought to call in the physician.

9th. *Science and Practice of Agriculture.*—This course should embrace, 1st, the history of agriculture; the general objects of agriculture; and the application of the sciences of chemistry, geology, botany, &c. to agriculture. Under this head, the origin, nature and composition of soils; manures, their composition and value, source of supply, application, &c.; the characters of the various agricultural plants, kitchen vegetables, fruit and forest trees, &c.; farm implements and machinery; the general effects of heat, light and electricity on vegetable growth, &c. &c. should all be fully discussed.

The course of practical agriculture should embrace all farm operations—such as ploughing, harrowing, seeding, draining, harvesting, irrigation, rotation of crops, &c. &c.; the cultivation of the various crops; the management of land in pasture and meadow soiling, &c.; the economy and management of slave labor; the different kinds and characters of live stock; principles of breeding, rearing, feeding and fattening of stock; the dairy, milk, butter and cheese; general principles to be observed in the erection of farm

buildings, &c. The whole to conclude with instruction in keeping farm accounts, the laws of enclosure, laws of tenure, and the laws relating to the owning and hiring of slaves.

In order to give greater efficiency to the instruction in practical agriculture, a farm should be purchased, and provided with a dairy, necessary farm buildings, implements, machinery, &c. Horses, cattle, &c. should be reared upon it, and it should be systematically cultivated.

A small portion of the farm, say a few acres, should be set aside for experimental purposes, to test new processes before applying them on a larger scale, or recommending them to the public. Another portion should be set apart for a fruit and vegetable garden, where the student would have opportunities for the study of horticulture, and where he could learn practically the various processes of grafting, budding, pruning, &c.; and another for a botanical garden, so as to enable the professor to illustrate the botany of agriculture to the fullest extent.

The students should have frequent opportunities for making themselves acquainted with the various operations of husbandry, and of becoming practically acquainted with the uses of the different implements. They should also in turn be put in charge of the different departments of the farm, such as the stables, reaping, threshing, &c.

Finally—In order to enable the professors in all the departments to illustrate the numerous applications of science to agriculture, an agricultural museum should be attached to the institution, in which should be found models of all approved agricultural implements and machines, and every kind of agricultural product, such as the different grains and grasses, every quality of tobacco, wool of every degree of fineness, models of fruit, vegetables, &c. &c., together with specimens of the various kinds of wood used for building, ornamental, and other purposes.

With this communication I transmit copies of the courses of instruction in the royal agricultural college of England, at Cirencester, and of the great school of Hohenheim in Prussia, from which it will be seen that the plan proposed agrees in its main features with that

adopted in these schools. As you, sir, have lately visited and critically examined into the practical working of the Hohenheim school, I hope you will favor me, by transmitting to the board of visitors with this report, some account of your observations, together with such suggestions as your visit to that school may have led you to believe would be valuable in this connection.

It only remains for me to show how we may engraft this course of instruction upon the institute course, so that any cadet who may desire it can avail himself of its advantages.

By reference to the course of instruction of the institute, as at present organized, it will be seen that provision is made for mathematics, natural philosophy, chemistry, mineralogy, geology, engineering, architecture and drawing; and that the time given to each of these subjects is sufficient, and in some cases more than sufficient for all the requirements of the agricultural student. The only subjects, therefore, for which provision must be made, are *natural history, medical and veterinary practice, and scientific and practical agriculture.*

The course of instruction of the institute is completed in four years, and is so arranged as to fill up the time completely, leaving no room for the introduction of new subjects. In order to obviate this difficulty, so as to secure ample time for the acquisition of the three branches mentioned above, I propose that at a given point in the course every cadet shall have the right of choosing whether he will take the agricultural course or the regular course. If he takes the former, his course from that time becomes modified; certain subjects, which to him as an agriculturist would be unimportant, should be omitted entirely, while others should be abridged or otherwise modified.

Thus the course of natural philosophy embraces, besides the mechanics, which is of great importance to the agricultural student, a full course of optics and astronomy. The whole of the optics might be omitted, as in no way necessary, while that of astronomy might be made more elementary. The instruction required in engineering would, as I have already shown, be very limited. The course of engineering, as now taught, is far more extensive than

would be required, while that of architecture would want considerable alteration, and some extension. A portion of time might be saved in the department of drawing, and in some others. After a careful consideration of the subject, I feel assured that ample time might be secured for the agricultural course in all its details.

In order to provide full instruction for an agricultural class in the institute, it would be necessary to have at least one additional professor, a *professor of agriculture*, and to secure a farm in its immediate vicinity. To the professor of agriculture I would assign the departments of natural history, and scientific and practical agriculture, while the instruction in human physiology and anatomy, &c. and in veterinary medicine, might very well be entrusted to the surgeon of the institute.

In order that the board of visitors may see at a glance what the entire agricultural course would be, if the above recommendations were adopted, I present it in tabular form, giving the studies of each year, and the time devoted to every subject.

First Year.

Mathematics, daily, the entire session.

Geography, daily, from 1st September to 1st January.

English grammar, daily, from 1st September to 1st January.

French, daily, from 15th January to 1st July.

Latin, every other day, from 15th January to 1st July—alternating with drawing.

Second Year.

Mathematics, daily, the entire session.

French, the same.

Latin, every other day—alternating with drawing.

Third Year.

Mathematics, daily, to 1st January.

Natural philosophy, daily, from 15th January to 1st July.

Chemistry, daily, from 1st September to 1st January, and from 15th January to 1st July, every other day—alternating with mineralogy and natural history.

Latin, daily.

Fourth Year.

Scientific and practical agriculture, daily, the entire session.

Rhetoric, logic, English literature and constitutional law, daily throughout the session.

Geology, every other day, from 1st September to 1st January—alternating with engineering and architecture.

Infantry and artillery tactics, every other day, from 15th January to 1st July—alternating with human physiology, &c. and veterinary practice.

Moral philosophy.

Thus it will be perceived that we have full time for the prosecution of all those studies which I have mentioned as necessary to the professional education of the farmer, without encroaching upon the time heretofore given to English, French, Latin, Rhetoric, English Literature, Constitutional Law, &c.—all of which are as necessary to the general education of the farmer as that of any other professional man; and by comparing this proposed course of instruction, and the time devoted to its acquisition, with that actually taught at Cirencester, or Hohenheim, it will be found to compare most favorably with either.

I am, colonel,

Very respectfully,

Your most ob't serv't,

WILLIAM GILHAM.

